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than an exposition of the approved practice of the present day. The next six chapters discuss the reduction and adjustment of a triangulation system. There are presented, successively, the spherical trigonometry involved, a discussion of the earth ellipsoid, the solution of an individual triangle, the adjustment of a chain of triangles, discussions of the rectangular and geographical systems of coordinates, and the calculation of the geographical coordinates of a triangulation net. In Chapter 8 is given a summary of the Prussian net, accompanied by a map.

The first seven chapters of the second volume continue the mathematical discussion. There are presented, successively, the geodetic line, the normal form, mathematical formulæ, projection after Gauss, transverse coordinates, the conical projection of the sphere and the spheroid, and the general properties of a geodetic triangle. The remaining two chapters, which occupy less than one third of Vol. II, cover the determination of elevations and the filling in of the topography.

JAMES GORDON STEESE.

Astronomy. By George F. Chambers. xxiii and 335 pp. Ills., index. D. Van Nostrand Co., New York, 1914. \$1.50. 6½ x 4½.

The sixth work on astronomy by Mr. Chambers, who is, however, a lawyer—astronomy being his avocation. The book is for the many who would not make a serious study of astronomy, however impressed with the splendor of the heavens. This outline of leading facts will greatly assist such readers; and though they may possess only a smattering of scientific knowledge, it will answer many questions, stimulate intelligent interest, and help inquirers to use, with profit and enjoyment, a small telescope or even an opera glass. The volume, though small enough to carry in a coat pocket, is remarkably rich in helpful illustrations, most of which are not in general circulation. Mathematical matters are kept in the background. The work first treats of the scope of astronomical science, and discusses in the succeeding chapters the sun, moon, tides, climates, eclipses, comets, shooting stars, stars, groups of stars and nebulae, the constellations, telescopes, time and its measurement, the spectro-scope, and, in the appendices, statistics relating to planets and their satellites and a catalogue of celestial objects that may easily be studied through small telescopes.

GEOMORPHOLOGY

Principles of Stratigraphy. By A. W. Grabau. xxxii and 1150 pp. Ills., index. A. G. Seiler & Co., New York, 1913. \$7.50. 9½ x 6.

Written for professional geologists and technical students, this massive treatise contains a large fund of valuable information, much of which had previously been difficult of access. The labor of collecting this material has evidently required years of painstaking endeavor, and the author himself has made important contributions from his own studies.

The introductory chapter supplies a general view of the facts and theories about the earth's divisions and general conditions, as well as a discussion of the several parts of geologic science. It is followed by seven large sections dealing with the atmosphere, hydrosphere, lithosphere, pyrosphere, centrosphere, biosphere and classification of geologic formations. Nearly half of the book is devoted to the lithosphere, but the hydrosphere and biosphere also receive extended treatment. The eight sections comprise thirty-two chapters, which deal with such topics as "The composition and physical character of the hydrosphere," "Classification of the rocks of the earth's crust," "Structural characters and lithogenesis of the marine hydroclastics," etc. Each chapter contains a description of conditions and sketches of the conclusions reached by the more important students of the respective fields. Most of the chapters on sedimentation include interesting comparisons of ancient and modern sediments, and each closes with a selected bibliography of the subject.

As the headings indicate, a wider field is surveyed than most stratigraphers would probably deem necessary under the caption of the book. The author has apparently thought it best to include a brief discussion of all phases of geology that ought to be a part of the mental equipment of a stratigrapher.

But in order to do this it was necessary to swell the volume to a thickness of nearly three inches, and even then it was not possible to give more than an elementary treatment of the many supernumerary topics, such as climate, rock metamorphism, biologic taxonomy, and evolution.

The table of contents shows that nearly half of the book deals with subjects which are not included in "stratigraphy" in the ordinary sense, although they have an important indirect bearing upon it. Practically all of these subjects have been as well and more elaborately set forth in various current treatises already familiar to geologists. Among these subjects are meteorology, physiography, vulcanism, and seismology. The introduction of lengthy, and yet in many instances inadequate, discussions of these subjects is not demanded except on the supposition that the student is to have access to no other geologic reference works. Some topics might well be omitted altogether, for there seems to be no vital need of a discussion of such things as the origin of the atmosphere, biologic taxonomy, and the condition of the earth's deep interior. If the author had held in check his evident desire to put into the book everything a stratigrapher ought to know, the price of the volume could have been kept within the reach of a much larger number of geologists, and the subject of sedimentation and others belonging to stratigraphy proper could have been more adequately discussed.

Even upon cursory inspection few readers of the book will fail to be impressed by the large number of unfamiliar technical terms which meet the eye. Some have been proposed by various European writers, but are not yet current even among stratigraphers; many are newly coined by the author. Some of the terms are really needed, because they express ideas which are otherwise only clumsily articulated. Thus "chronofauna" and "locofauna" discriminate between the animal society of a geologic epoch or period and that of a certain district. Many of the new terms, however, are not really demanded, even though they have a certain appropriateness. Others, such as "phytology" for botany and "atmology" for meteorology, duplicate terms already of long standing and are therefore needless. Finally, the passion for providing a term for each pigeonhole in the author's elaborate classification results, for example, in the invention of the word "biometamorphism" to cover the trivial process of rock metamorphism through the action of organisms. On the whole, the book would be just as effective, and would be received more cordially by the geological fraternity, if most of the new terms had been left out.

The book is to be commended for its generally impartial treatment of unsettled questions in geology. Nevertheless, there are some important lapses from this good standard. Among several well-founded hypotheses to account for the anomalies of ancient climates only the picturesque "Pendulations-theorie" is considered; and contorted layers and "edgewise conglomerates" in limestones are ascribed to subaqueous gliding only.

A slightly different manifestation of the same tendency is observable in the many hasty or ill-considered statements apparently of opinions entertained by the author. Lack of space forbids illustration of them here, but nearly every geologist who examines the book will find instances which will tend seriously to weaken his confidence in the author's statements about less familiar subjects.

In extending his work over so broad a field it is humanly impossible for an author to avoid making occasional mistakes as to facts, and so it is not surprising that a few are to be found in almost every chapter of the "Principles of Stratigraphy." As is also but natural, not all of the manifold subjects in the book are equally well handled. The pages on rock metamorphism do not reveal a wide acquaintance or a clear understanding of that complex subject. On the other hand, the chapters on the "biosphere" and sedimentation are generally good.

The numerous illustrations, although chiefly woodcuts and line drawings, serve their purpose sufficiently. It is regrettable that the index is not more nearly commensurate with the size of the volume. It lacks reference to some important things, which, nevertheless, the reader may stumble upon somewhere in the text. Thus, neither *chert* nor *marl* is mentioned in the index, and for a discussion of *mud cracks* the reader is referred to a casual mention on page 512, although the subject is fully treated on pages 709 to 711.

In general, Mr. Grabau's book assists in putting the science of stratigraphy upon a modern basis, with its principles as definite and well classified as those of physiography and other branches of geology. ELIOT BLACKWELDER.

METEOROLOGY AND CLIMATOLOGY

Das Problem der Klimaänderung in geschichtlicher Zeit. Von L. Berg. (*Geogr. Abhandl.* Herausgegeben von A. Penck. Vol. 10, No. 2.) 70 pp. B. G. Teubner, Leipzig, 1914. Mk. 3.60. 10 x 7.

Those who have been trying to keep abreast of the current literature on changes of climate within historic times will find themselves greatly indebted to Dr. Berg, who has made an excellent digest of this scattered material. The earlier pages deal with certain theoretical considerations which relate to the desiccation hypothesis. A critical examination is made of the evidence of climatic oscillations or changes which is provided by rivers, lakes, deserts, soil and vegetation. Finally, the author turns to the individual countries from which evidence of desiccation has been brought forward and shows what conclusions should, in his judgment, be drawn from the facts. The discussion is pointed, clear, and interesting. Dr. Berg's conclusions are stated in no uncertain terms. From glacial times to the present there is almost everywhere evidence of a decrease in the waters of lakes and rivers, and in precipitation. A warmer and drier climate preceded the present epoch. Within historic times there does not appear to have been anywhere a progressive change of climate to a warmer and drier one. Climate is either steady (except for oscillations, whose period is at most a few decades, like the Brückner period), or there is even a tendency toward increasing moisture. R. DEC. WARD.

Traité de Météorologie. Par J. Vincent. viii and 418 pp. Maps, ills., index. A. Dewit, Brussels, 1914. Fr. 5. 8 x 5½.

We have had no meteorological text-book in French since that of Angot. In this new volume, rather more attention than usual is paid to the simpler physical facts and laws regarding the atmosphere, and there are numerous illustrations of physical experiments. Optical phenomena are also considered more fully than in many elementary text-books on meteorology. The book is not well adapted for teaching, because it lacks system, and there is not that effective correlation of the various elements which makes systematic instruction in meteorology so effective. Examples are drawn largely from Belgium. There are no bibliographic references. Authors are named, but their titles are not given. M. Vincent's volume will doubtless have local interest in Belgium, and as the product of the author's long and excellent service in meteorological work in Belgium it is to be welcomed. R. DEC. WARD.

Lehrbuch der Meteorologie. Von Julius Hann. Dritte, unter Mitwirkung von Prof. Dr. R. Süring, umgearbeitete Auflage. Parts 1-9. 800 pp. Maps, ills. C. H. Tauchnitz, Leipzig, 1913, 1914.

The first edition of von Hann's splendid "Lehrbuch der Meteorologie" appeared in 1901. Complete, systematic, compact, clear—the work of the acknowledged master of the science of the atmosphere—the book was universally welcomed and accepted as the standard meteorological text-book of the world. Within the short period of five years the author found time to issue a second, revised edition, about 150 pages shorter than the first. The second differed from the first chiefly in the omission of a large number of bibliographical foot-notes, in the condensation of some of the subject-matter, and in the addition of references to all important new material which had been published in the interval 1901-1906.

So satisfying to meteorologists were the first two editions of this absolutely indispensable volume that probably few of us ever expected another edition. Yet others besides the reviewer must have cherished the hope that the veteran author would, in spite of his advancing years, find time to prepare still another issue which would, once more, give us the satisfying feeling that in one book